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MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

FOOD STANDARDS COMMITTEE REPORT ON ANTIOXIDANTS IN FOOD

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1963
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Food Standards Committee

The terms of reference of the Food Standards Committee are:

To advise the Secretary of State for Scotland, the Minister of Agriculture, Fisheries and Food, the Minister of Health, and as respects Northern Ireland the Secretary of State for the Home Department, on the composition, description, labelling and advertising of food with particular reference to the exercise of the powers conferred on Ministers by Sections 4, 5 and 7 of the Food and Drugs Act, 1955, and the corresponding provisions in enactments relating to Scotland and Northern Ireland.

The members of the Food Standards Committee are:

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Food Additives and Contaminants Suh-Committee

The terms of reference of the Food Additives and Contaminants Suh-Committee are:

To consider prohlems referred to the Suh-Committee hy the Food Standards Committee in relation to all suhstances added to food, whether deliherately or not.

The following served on the Food Additives and Contaminants Sub-Committee during the preparation of this report:

Sir CHARLES DODDS, M.V.O., M.D., D.Sc., F.R.C.P., F.R.I.C., F.R.S. (*Chairman to March, 1962*)

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Professor E. BOYLAND, D.Sc., Chester Beatty Research Institute.

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R. GOULDING, Esq., M.B., B.Sc., Ministry of Health.

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FOOD STANDARDS COMMITTEE

Report on the Review of the Antioxidant in Food Regulations, 1958

The Food Standards Committee have considered and adopted a Report by their Food Additives and Contaminants Sub-Committee on the review of the Antioxidant in Food Regulations. The Report is as follows:

I. INTRODUCTION

1. We were asked to review the Antioxidant in Food Regulations, 1958 and to consider whether, and to what extent, amendments were necessary. We were also asked to consider and advise on the representations received as a result of the announcement of the review and particularly to consider if the regulations ought to be amended to include official specifications for the permitted antioxidants and, if so, what these specifications should be.

2. We have come to the conclusion that the scope and form of the present Regulations are satisfactory and that there is no need for any major amendment. We have borne in mind in our review the general principle that an antioxidant should only be allowed to be used in food when there is evidence of a real need—not merely some minor commercial advantage —and when it can be shown that its use is likely to benefit the consumer without presenting a foreseeable hazard to health.

II. CONSIDERATION OF THE ANTIOXIDANTS AT PRESENT PERMITTED

3. We asked our Pharmacology Panel to reconsider the antioxidants at present permitted and we include the substance of their advice, which we have adopted, at Appendix I. Although they stated (paragraph 11) that none of these antioxidants had been fully tested for carcinogenicity they concluded that a hazard to health was unlikely to arise from the continued use of butylated hydroxyanisole (B.H.A.) and propyl, octyl and dodecyl gallates ; but they thought that the margin of safety for butylated hydroxy-toluene (B.H.T.) was less than for the other permitted antioxidants and recommended that its use in food should be discontinued unless it could be shown to have over-riding technical advantages. We do not think that any technical advantages that B.H.T. may have can be said to outweigh the doubts cast on its safety by the Pharmacology Panel. We, therefore, recommend that it should no longer be permitted as an antioxidant for use in food.

III. CONSIDERATION OF REPRESENTATIONS FOR ADDITIONS TO THE LIST OF PERMITTED ANTIOXIDANTS

Dinonyl Citrate

4. We have received representations, though not from food manufacturers, that dinonyl citrate should be permitted as an antioxidant. We are not convinced of the need for dinonyl citrate. We have not received any evidence that dinonyl citrate is more effective than, say, citric or tartaric acid. We do not recommend, therefore, that dinonyl citrate should be added to the list of permitted antioxidants.

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Nordibydroguaiaretic Acid (N.D.G.A.)

5. We have considered representations that N.D.G.A. should be added to the list. There seems to be no evidence that it is in any way more effective than the antioxidants at present permitted and it does not, therefore, satisfy our criterion of need. We do not, therefore, recommend that it should be permitted.

Erythorbic Acid (Isoascorbic Acid) and its Salts

6. It has been suggested that erythorbic acid (isoascorbic acid) and its salts should either be added to the list of permitted antioxidants or should be excluded from the definition of 'antioxidant'. It was feared that the addition of these substances to food might well vitiate the determination of vitamin C content. This is no longer the case as methods are now available for the determination of vitamin C in the presence of erythorbic acid. We think however that the need to use erythorbic acid is not such as to satisfy our criteria of need particularly in view of the permitted use of ascorbic acid. We do not therefore recommend that erythorbic acid and its sodium and potassium salts be added to the permitted list, nor be excluded from the definition of antioxidant in the Antioxidant in Food Regulations, 1958 to allow its use in food.

Diphenylamine and Ethoxyquin

7. Requests have been made for the approval of diphenylamine and ethoxyquin (or 1,2 dihydro-6-ethoxy-2,2,4-trimethylquinoline, the active principle in the proprietary preparation 'stop scald') which are used in other countries for the prevention of common scald of apples and pears during storage. Common scald is said to cause considerable losses especially among stored apples. Since diphenylamine and ethoxyquin may be properly regarded as antioxidants within the definition in the current regulations, their presence in food is forbidden. We have received some evidence that diphenylamine is more efficient than ethoxyquin and that both substances are more effective and cheaper to use than oiled wraps. It was therefore represented that both these substances are needed by the trade and that their presence up to 10 parts per million on apples in the case of diphenylamine and up to 2 parts per million on apples and pears in the case of ethoxyquin should be allowed. The toxicity data provided on both was sufficient for us to reach a conclusion that ethoxyquin is to be preferred. We also concluded that there is no overriding need for two substances to be permitted. We therefore recommend that ethoxyquin only should be allowed at a level of up to 2 parts per million on apples and pears.

IV. CONSIDERATION OF FOODS IN WHICH ANTIOXIDANTS ARE AT PRESENT PERMITTED

8. We do not see any reason to alter the list of foods in which antioxidants are at present permitted. We do think, however, that the description: 'Essential oils, including their flavouring constituents—isolates and concentrates' is ambiguous if not positively misleading. We suggest that it be amended to read: 'Essential oils and isolates from and concentrates of essential oils'.

9. We think it important that a provision should be included in the regulations to prohibit the presence of antioxidant, from whatever source, in foods intended for infant feeding.

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V. CONSIDERATION OF REPRESENTATIONS FOR ADDITIONS TO THE LIST OF SPECIFIED FOODS

General

10. We have received representations that antioxidants should be permitted in the following foods: debydrated potatos (flakes or powder), breakfast cereals, sausage rusks, dried soup mixes containing meat and meat fat (including cbicken), meat and vegetable products, frozeu bams, parboiled rice, dried milk and dried cream for manufacturing purposes, nuts, packaged, chopped and comminuted, comminuted drinks and protein/oil complexes made from ground nuts and other oil seeds. We have also been asked to consider whether antioxidants should be permitted in chewing gum.

11. We have carefully considered tbese representations but we are not satisfied that a case bas been made out on a basis of need for the use of antioxidants in any of these foods or in chewing gum. We do not think that tbe use of an antioxidant is justified merely to increase tbe sbelf life of a food wben this is already adequate without the addition of an antioxidant. We recommend that all these representations should be rejected.

Naturally Fatty Foods

12. A somewhat parallel series of representations suggest that tbere is an anomaly in the present regulations in that they only allow antioxidants to be used if incorporated in an added fat and do not allow their use in foods that contain fat as a natural part of their composition. In our view, this restriction in the present regulations is desirable in tbat it limits the wbolesale addition of antioxidants to food. The addition of antioxidants to refined fats was permitted because during processing they are denuded of natural antioxidants, but this is not true of unrefined fats or natural fatty foods. If convincing evidence were provided that a particular food containing natural fat could not be produced and marketed economically without an added antioxidant, we would be prepared to consider if an amendment would be justified to cover the particular case, but we do not think that an amendment in tbe general terms suggested is justified.

Synthetic Vitamins and Products containing Very High Concentrations of Vitamins

13. It bas been represented that synthetic vitamins and products containing very high concentrations of vitamins should not be classified under the heading 'vitamin oils and concentrates', but sbould be dealt with in a separate category. Natural oils, and concentrates prepared from them, usually contain sufficient natural antioxidant to confer stability on the preparations, but, it is suggested, antioxidants must be added in the case of synthetic products. It is further suggested that it would be more logical to relate the level of antioxidant to the vitamin A content than to weigbt and that the permitted level for these vitamins should be increased and expressed as 10 mg of any mixture of B.H.A. and B.H.T. per 1,000,000 international units of vitamin A. The need for additional antioxidant is confined to the oil soluble vitamins, and to vitamin A in particular. Tbe small amount of experimental data submitted indicates that the vitamin A content of very high potency oils falls rapidly on free exposure to air and that this loss can be prevented by a suitable combination of B.H.A. and B.H.T. The basic maximum of 200 p.p.m. of antioxidant is insufficient to prevent loss of vitamin A and, if the suggestion mentioned above were adopted, it would mean that a preparation containing 1 million international

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units per gram vitamin A would be able to have 10·2 mg. antioxidant per gram i.e. the oil would contain 1·02 per cent antioxidant or 10,200 p.p.m. instead of the present maximum of 200 p.p.m. of these antioxidants.

14. We agree that some increase in antioxidant is necessary in products containing very higb concentrations of vitamin A, but in view of our recommendation in paragraph 3 above, we could not countenance the use of B.H.T. We consider that any increase in antioxidant content sbould be governed by the vitamin A potency only and should be confined to preparations containing more than 100,000 I.U.'s per gram. Preparations of lower potency would be subject to the provisions on antioxidants laid down for vitamin oils and concentrates.

15. We recommend that the regulations be amended to permit preparations containing over 100,000 I.U.'s vitamin A per gram to contain 10 p.p.m. of B.H.A. for eacb 1,000 I.U.'s vitamin A contained in each gram of the preparation.

VI. MINOR AMENDMENTS TO THE REGULATIONS

Definition of Antioxidant

16. It bas been suggested tbat the definition of antioxidant sbould make it quite clear that not only tocopberols but also natural foods containing them should be excluded from tbe definition. We assume that this is tbe intention of the present regulation and we do not think any amendment is necessary. This is, however, entirely a matter of legal drafting whicb we recommend should be considered wben amending regulations are being prepared.

Expression of Limits for Permitted Gallates in Terms of Gallic Acid

17. We bave been asked to consider wbether there would not be advantages in expressing the limits for gallates in terms of gallic acid since the effective part of tbe esters is the gallic acid content and since analysis for the purposes of enforcement would be simplified by replacing lengtby quantitative determination of mixtures of gallates by the more economical qualitative detection togetber witb total gallic acid determination. We do not think tbe ease of analytical determination is in itself a sufficient reason for altering the expression of the limits for gallates and we are not convinced tbat it would be generally advantageous to cbange tbe present method of expressing those limits.

VII. LEACHING OF ANTIOXIDANTS FROM PLASTIC AND OTHER CONTAINERS

18. The question of the possible leaching of small quantities of antioxidants from plastics and otber containers bas been brought to our notice. Ministers bave already asked us to undertake in due course a general review of the question of additives adventitiously introduced into food in tbe course of preparation and processing, including the leaching of substances from wrappers. We bave this under consideration, but until sucb a review is made we make no recommendation on this matter in this report on food additives.

VIII. LABELLING OF ANTIOXIDANTS

19. We have not reviewed tbe regulations which deal with tbe labelling of antioxidants since the Food Standards Committee is at present engaged in a review of all food labelling regulations.

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IX. SPECIFICATIONS

20. In the previous Report on Antioxidants, which was published in 1954, it was recommended that specifications as to the purity of permitted antioxidants should be prescribed. We repeat this recommendation. Specifications of purity for antioxidants occur in the British Pharmaceutical Codex and in the Third Report of the Joint FAO/WHO Expert Committee on Food Additives. We recommend that generally speaking the FAO/WHO Standards should be adopted because of the desirability of internationally accepted specifications of purity.

21. However, in our view, there is a need to supplement the FAO/WHO Standard for B.H.A. by including a statement of the percentage of the 3-isomer (the active isomer) and we recommend accordingly. Further, the limits for arsenic in the FAO/WHO Specifications are not entirely in accord with those prescribed in the Arsenic in Food Regulations. We recommend that the part of the specifications dealing with limits for arsenic and lead should be deleted and replaced by a statement as follows:—'the limits for arsenic and lead must conform to the Arsenic in Food Regulations, 1959, as amended, and the Lead in Food Regulations, 1961, respectively'. The specifications we propose are set out in Appendix II.

X. REVIEW

22. We recommend that any revised regulations made as a result of this report should be reviewed five years after they are made.

XI. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

23. (*a*) Butylated hydroxytoluene should be withdrawn from the list of permitted antioxidants (para. 3).

(*b*) Erythorbic Acid and its Salts should not be excluded from the definition of "antioxidant" (para. 6).

(*c*) Ethoxyquin should be permitted on apples and pears up to 2 parts per million (para. 7).

(*d*) The description of essential oils etc. in the First Schedule should be clarified (para. 8).

(*e*) Antioxidants should be prohibited in infant foods (para. 9).

(*f*) Preparations containing over 100,000 I.U.'s vitamin A per gram should be allowed to contain 10 p.p.m. of butylated hydroxyanisole for every 1,000 I.U.'s vitamin A per gram (para. 15).

(*g*) Specifications of purity of permitted antioxidants should be prescribed (para. 20).

(*h*) Any revised regulations should be reviewed after five years (para. 22).

September, 1963

FSC/FAC/REP. 3.

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PROPYL, OCTYL AND DODECYL GALLATES, BUTYLATED HYDROXYANISOLE AND BUTYLATED HYDROXYTOLUENE

INTRODUCTION

1. The Pharmacology Panel was asked to assess the pharmacological data available for the five scheduled antioxidants which are at present permitted in specified foods by the terms of the Antioxidant in Food Regulations, 1958. These antioxidants are defined in the First Schedule to the Regulations as:—

n—Propyl gallate (n—propyl 3:4:5—trihydroxybenzoate)

n—Octyl gallate (n—octyl 3:4:5—trihydroxybenzoate)

n—Dodecyl gallate (n—dodecyl 3:4:5—trihydroxybenzoate)

Butylated hydroxyanisole (a mixture of 2-*tert*butyl-4-hydroxyanisole and 3-*tert*butyl-4-hydroxyanisole) (B.H.A.)

Butylated hydroxytoluene (2:6 di-*tert*butyl-p-cresol) (B.H.T.).

STANDARDS OF COMPOSITION AND SPECIFICATIONS OF PURITY

2. In addition to information supplied by manufacturers, the Panel also had available the British Pharmaceutical Codex (1959) specification for propyl gallate, and the specifications for all five antioxidants as listed in the F.A.O./W.H.O. "Specifications for Identity & Purity of Food Additives"(1). The Panel notes, in particular, that commercial preparations of B.H.A. may contain different proportions of the 2-tertiary butyl and 3-tertiary butyl isomers. It seems probable that the previous Food Standards Committee recommendation to permit the use of B.H.A. was based on data for a product which contained a higher proportion of 2-isomer than is present in currently available preparations.

DATA ON TOXICITY TO ANIMALS

Butylated Hydroxyanisole and the Gallates

3. There is very little toxicity data additional to that available in 1958 when the Antioxidant in Food Regulations came into effect. *Brown, Johnson and O'Halloran*(2) fed albino rats for 2 years on diets containing 0·1 per cent B.H.A. (100 times the maximum normally expected to be found in human food) and Norway Hooded rats for 8 months on diets containing 0·5 per cent B.H.A. The fat containing the antioxidant had been heated to 150° C. for half an hour before incorporation into the diet of the Norway Hooded rats. Growth, food consumption, reproduction, mortality, organ weights and post-mortem pathology were normal.

4. *Karplyuk*(3) fed rats with B.H.A. and with propyl gallate at levels of 600 mg/kg body weight and 500 mg/kg body weight respectively (one-fifth the LD50) for from 68 to 82 days. No changes were observed in the behaviour of the experimental animals, but growth rates were slightly reduced and there was a reduction in the peroxidase activity of the blood. B.H.A. also caused a reduction in blood catalase activity and, on autopsy, the liver weights of animals fed this antioxidant were higher than those of the controls.

5. *Ostby and Gregory Wilder*(4) reported the results of feeding Cocker Spaniel pups with B.H.A. for 15 months at levels of 5, 50 and 250 mg per kg body weight per day. Liver injury occurred at the highest dosage.

6. Taking into account both the above data and data previously available, these are generally satisfactory for propyl gallate and B.H.A. as regards number of species tested. For propyl gallate, the duration of the experiments was satisfactory for rats, but long-term toxicity tests on guinea pigs and on dogs were not carried out for a sufficient period. The data presented for octyl and dodecyl gallates were confined almost exclusively to feeding tests on rats. The tests on propyl gallate and on B.H.A. have taken into account the possibility that the toxicity of antioxidants may be changed at temperatures used in food preparation, but this information is lacking for octyl and dodecyl gallates.

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Butylated Hydroxytoluene

7. Before the publication of the Antioxidant in Food Regulations, 1958, much of tbe information available on the toxicity of B.H.T. came from the results of extensive experiments carried out by *Deichmann, Clemmer, Rakoczy and Bianchine*(5). Their results indicated that the dietary levels at which B.H.T., B.H.A. and the gallates caused abnormal effects in animals were similar. In a two-year experiment on rats, diets containing up to and including 0·8 per cent B.H.T. had no adverse effects.

8. In the experiments by *Deichmann and others* the rat diets contained 1 per cent lard and the total fat content of the diet probably did not exceed 5 per cent by weigbt. More recently, *Brown, Johnson and O'Halloran*(2) studied the effect on rats of B.H.T. and B.H.A. at levels of up to 0·5 per cent in a diet containing 10 per cent or 20 per cent added fat—amounts of fat which are not unusual in man's diet but which are ahnormal in the diet of the lahoratory rat. B.H.T. compared unfavourably with B.H.A. in the extent to which it decreased the initial growth rate and increased the liver weight relative to the body weight. A significant loss of hair on the head occurred in rats, under conditions of stress, when their diets contained 0·1 per cent or more of B.H.T., and this effect was enhanced with increasing lard content in the diet. Three out of tbirty rat litters contained young horn without eyes when the parents had been fed for five months on diets containing B.H.T. The condition was not observed in any of the stock or other experimental rats.

9. *Karplyuk*(3)(6) fed rats for from two to three months with daily doses of B.H.T., B.H.A. and propyl gallate dissolved in lard. The amounts of antioxidants fed were about 0·3 per cent in the diet. Under the conditions of the experiment B.H.T. was judged to be the most toxic of the antioxidants tested since it alone had a harmful action on the liver, disturbing the processes of pbospbolipid synthesis, cleavage and removal of neutral fats from the liver. Only B.H.T. reduced the activity in the hlood of all the three enzyme systems studied, namely, catalase, peroxidase and cbolinesterase.

METABOLIC STUDIES

10. Little attention seems to be been given to investigation of any possible effect that these antioxidants may have on biochemical (e.g. enzyme) activity. There is evidence that B.H.A. is metabolised hy simple direct conjugation to glucuronides and formation of ethereal sulpbates(7)(8)(9)(10) whereas oxidation of a methyl group is necessary hefore B.H.T. can be similarly metaholised and excreted(8)(11). *Golder, Ryan and Wright*(12) injected 97 ug. of tritiated B.H.A. and 100 ug. of tritiated B.H.T. into rats. Ninety per cent of the tritiated B.H.A. was excreted in the urine within 4 days but only 35 per cent of the tritiated B.H.T.

CARCINOGENESIS

11. The Panel reported that none of these antioxidants bas been fully tested for carcinogenicity according to the requirements of tbe Panel on Carcinogenic Risks in Food Additives and Pesticides set up by the Chief Medical Officer of the Ministry of Health's Committee on Medical and Nutritional Aspects of Food Policy(13).

TOXICITY TO MAN

12. Apart from propyl gallate, where 0·5 g. was fed to a buman volunteer for six consecutive days without apparent ill effect(14) and B.H.A. where men were given single oral 50 mg. doses(10)—no direct feeding tests on humans seem to bave been reported.

SUMMARY

13. (a) *Propyl Gallate*

Specifications are available. Data on toxicity to animals are generally satisfactory as regards number of animals and species. Duration of test is satisfactory for rats hut long-term toxicity tests on guinea pigs and dogs are not of sufficient duration. The data take into account the effect of

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heat on fat containing antioxidant but little attention has been given to the detection of biochemical activity. A test has been carried out on a human volunteer, but none of the tests has been designed to investigate the possibility of carcinogenicity. There is no evidence of gross toxicity.

(b) *Octyl and Dodecyl Gallates*

Specifications are available. Toxicity data are confined almost exclusively to feeding tests on rats and no tests with heated antioxidant were included. Information about possible carcinogenicity is lacking. The somewhat limited data do not show evidence of gross toxicity.

(c) *Butylated Hydroxyanisole*

Specifications are available. Data on toxicity to animals are generally satisfactory as regards number of animals and species but long-term tests on animals other than rats are not of sufficient duration. The data take into account the effect of heat on the antioxidant and also the possibility that other additives in the diet may have a synergistic effect on toxicity. Information is available on the metabolism of B.H.A. in the rabbit. Little attention has been given to detection of biochemical activity and information about possible carcinogenicity is lacking. The data indicate some degree of long-term toxicity—in particular, liver damage to dogs occurs at high dosage rates.

(d) *Butylated Hydroxytoluene*

Specifications for purity are available. Animal experiments showed that B.H.T. was not differentiated from other antioxidants when amounts up to 0·8 per cent were added to a diet containing 1 per cent lard, but was so differentiated when the animal diet contained 20 per cent of lard. The adverse findings were—decreased initial growth rate, increased liver weight relative to body weight and loss of hair under conditions of stress. A small proportion of offspring from rats fed B.H.T. were born without eyes, a phenomenon absent from the controls. From studies of the effect on enzyme systems, B.H.T. was considered to be more toxic than other permitted antioxidants. Metabolic studies show that B.H.T. is eliminated from the animal more slowly than B.H.A. Direct experiments to investigate possible carcinogenesis are lacking. There seems to be no information on the effect on man, but the sum of the information available indicates the margin of safety is less for B.H.T. than for other antioxidants.

SUBSTANCE OF PANEL'S RECOMMENDATIONS

(a) *The Gallates and Butylated Hydroxyanisole*

Although further tests are required to assess the possibility of carcinogenicity and to evaluate the significance of bio-chemical activity, a hazard is unlikely to arise from the continued use of propyl octyl and dodecyl gallates and of B.H.A. as antioxidants in accordance with the present Antioxidant in Food Regulations.

(b) *Butylated Hydroxytoluene*

The available information indicates that the margin of safety for B.H.T. is less than for the other permitted antioxidants and its use should be discontinued unless it can be shown to have over-riding technical advantages compared with the other permitted antioxidants. This view is reinforced by the cautious attitude towards the use of B.H.T. adopted in the Sixth Report of the Joint F.A.O./W.H.O. Expert Committee on Food Additives (1962)([15]). This Expert Committee gave only a conditional acceptable intake level (up to 0·5 mg/kg. body weight) for B.H.T. and proposed that it be used under scientific supervision.

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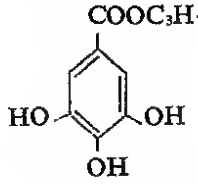
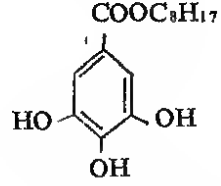
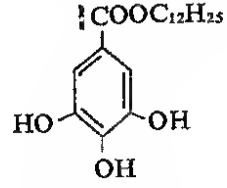
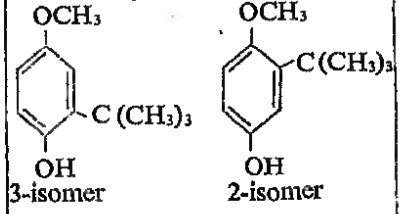
SPECIFICATIONS FOR ANTIOXIDANTS

Antioxidant	Empirical Formula	Structural Formula	Molecular Weight	Description	Purity	Melting Point	Loss on Drying	Sulphated Ash
PROPYL GALLATE	$C_{10}H_{12}O_5$		212·20	White to creamy-white crystalline powder, odourless, taste slightly bitter.	Min. 99·0%(1)	146–148°(1)	Max. 0·5%(1)	Max. 0·05%
OCTYL GALLATE	$C_{15}H_{22}O_5$		282·20	White to creamy-white solid, odourless, taste slightly bitter.	Min. 98·5%(2)	100–101°(2)	Max. 0·5%(2)	Max. 0·05%
DODECYL GALLATE	$C_{19}H_{30}O_5$		338·20	White to creamy-white solid, odourless, taste slightly bitter.	Min. 98·5%(2)	96–97°C(2)	Max. 0·5%(2)	Max. 0·05%
BUTYLATED HYDROXY-ANISOLE (B.H.A.)	$C_{11}H_{16}O_2$		180·25	White or slightly yellow waxy crystalline solid with an aromatic odour.	Min. 98·5% not less than 90·0% of the 3-isomer.	Min. 50°C	not specified	not specified

[*continued overleaf*

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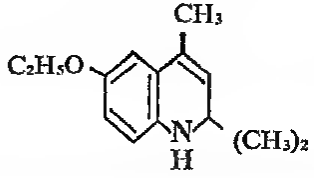
SPECIFICATIONS FOR ANTIOXIDANTS

Antioxidant	Empirical Formu	Structural Formula	Molecular Weight	Description	Purity	Boiling Point	Refractive Index	Solubility
ETHOXYQUIN	$C_{14}H_{19}NO$		217·3	Light amber oil when freshly prepared. Tendency to polymerise on exposure to light and oxygen with darkening in colour.	Not less than 92 per cent. by weight of the monomer. Remainder consists of the dimer and higher polymers.	125°C at 1–2 mm. mercury.	1·569 to 1·572 at 25°C.	Insoluble in water. Soluble in organic solvents, and oils and fats.

(1) After drying at 110°C for 4 hours. (2) After drying at 60°C for 4 hours.

NOTE.—The limits for Arsenic and Lead must conform to the Arsenic in Food Regulations 1959 and the Lead in Food Regulations 1961 respectively, i.e., As =2 p.p.m., Pb = 10 p.p.m.

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APPENDIX III

Information and/or representations, oral or written, have been received from the following organisations and other interests concerned with the use of antioxidants in food—

Agricultural Attaché, American Embassy.
Association of Cereal Food Manufacturers Ltd.
Association of Public Analysts.
J. Bibby and Sons Ltd.
British Essence Manufacturers' Association.
British Food Manufacturing Industrial Research Association.
British Glues and Chemicals Ltd.
British Plastics Federation.
Cake and Biscuit Alliance Ltd.
J. M. Collett and Co. Ltd.
Comet Rice Mills, Texas.
John Crampton and Co. Ltd.
Distillers Co. Ltd.
East Malling Research Station.
F. M. S. (Farm Products) Ltd.
Food Manufacturers' Federation Incorporated.
Glaxo Laboratories Ltd.
Glutamates Ltd.
H. J. Heinz Company Ltd.
Home Grown Fruits Ltd.
Imperial Chemical Industries Ltd.
John Mackintosh & Sons Ltd.
May and Baker Ltd.
Medical School, University of Birmingham.
Monsanto Chemicals Ltd.
M. P. P. (Products) Ltd.
National Association of Soft Drink Manufacturers Ltd.
National Farmers' Union.
National Federation of Fruit and Potato Trades Ltd.
National Federation of Meat Traders' Association.
Office of the High Commissioner for Australia.
Provision Importers' Association.
Roche Products Ltd.
Soya Foods Ltd.
Herbert Smith and Co.
Wm. J. Stange Co. Chicago.
The Wrigley Company.
University of Cambridge and Agricultural Research Council.
U.S. Packers Provision Agents' Committee.
Wallerstein Company.

(81621) Wt. 3745/3050 K18 10/63 St.S.

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